

Claims

1. A communication mode controlling method for use in a mobile communication system provided with a mobile communication terminal having a function of switching between an autonomous mode in which the mobile communication terminal autonomously carries out data communications with a base station, and a scheduling mode in which the mobile communication terminal carries out data communications with said base station at a permitted communication timing, and an RNC (Radio Network Controller) for managing communication resources for said base station and said mobile communication terminal, said communication mode controlling method comprising:

a threshold determination step in which said base station and/or said RNC determines a threshold value used for switching between said communication modes and associated with an amount of communication data in a communication data buffer which said mobile communication terminal has according to an amount of interference in each of said communication modes in a cell of said base station, and/or communication characteristics thereof; and

a notification step in which said base station notifies the threshold value associated with said amount of communication data determined in said threshold determination step to said mobile communication terminal.

2. A communication mode controlling method for use in a mobile communication system provided with a mobile communication terminal having a function of switching between an autonomous mode in which the mobile communication terminal autonomously carries out data communications with a base station, and a scheduling mode in which the mobile communication

terminal carries out data communications with said base station at a permitted communication timing, and an RNC for managing communication resources for said base station and said mobile communication terminal, said communication mode controlling method comprising:

a communication mode determination step in which said base station and/or said RNC determines a communication mode which should be set to said mobile communication terminal based on an amount of interference in each of said communication modes in a cell of said base station, and/or communication characteristics thereof, and a signal indicating an amount of communication data notified from said mobile communication terminal; and

a notification step in which said base station notifies the communication mode determined in said communication mode determination step to said mobile communication terminal.

3. The communication mode controlling method according to Claim 2, characterized in that in the communication mode determination step, either the base station or the RNC determines a threshold value used for switching between said communication modes and associated with the amount of communication data in a communication data buffer which said mobile communication terminal has according to the amount of interference in each of said communication modes in the cell of said base station, and/or the communication characteristics thereof, and said base station determines the communication mode which should be set to said mobile communication terminal according to a result of comparison between said threshold value and the amount of communication data in said communication data buffer.

4. The communication mode controlling method according to Claim 3, characterized in that in the communication mode determination step, when determining that any delay time is not permitted in the data communications based on a delay tolerance set to data communications by the mobile communication terminal, either the base station or the RNC increases said threshold value such that the amount of communication data does not reach the threshold value, and so that the mobile communication terminal switches to the autonomous mode having a communication characteristic of producing a delay time more difficultly than the scheduling mode, whereas when determining that a delay time is permitted in the data communications, either the base station or the RNC decreases said threshold value such that the amount of communication data is equal to or larger than the threshold value, and so that the mobile communication terminal switches to said scheduling mode.

5. The communication mode controlling method according to Claim 3, characterized in that in the communication mode determination step, either the base station or the RNC determines the threshold value according to a change per one mobile communication terminal in the amount of interference permitted in the autonomous mode, which is dependent upon a number of mobile communication terminals in the autonomous mode which are staying in the cell of said base station.

6. The communication mode controlling method according to Claim 3, characterized in that in the communication mode determination step, either the base station or the RNC determines the threshold value of the communication data buffer of each mobile communication terminal so that said each mobile communication terminal switches to a communication mode having

a communication characteristic permitted by a QoS (Quality of Service) parameter set to the data communications by said each mobile communication terminal.

7. The communication mode controlling method according to Claim 3, characterized in that the base station includes a step of dividing mobile communication terminals which are accommodated in the cell thereof according to QoS parameters set to the data communications with the mobile communication terminals into groups, and, in the communication mode determination step, either said base station or said RNC determines the threshold values of the communication data buffers of said mobile communication terminals so that each of said mobile communication terminals switches to a communication mode having a communication characteristic permitted by QoS parameters set for one of said groups to which each of said mobile communication terminals belong, and said base station determines a communication mode which should be set to each of said mobile communication terminals according to a result of comparison between said threshold value and the amount of communication data in the communication data buffer of each of said mobile communication terminals, and, in the notification step, said base station simultaneously notifies, as broadcast information, the communication mode determined in said step to each of said mobile communication terminals which is divided into one of said groups.

8. The communication mode controlling method according to Claim 3, characterized in that in the communication mode determination step, either the base station or the RNC determines the threshold value for the communication data buffer of each mobile communication terminal so that said each

mobile communication terminal switches to a communication mode having a communication characteristic permitted by QoS parameters set for data communications by said each mobile communication terminal, and said base station determines a communication mode which should be set to said each mobile communication terminal according to a result of comparison between said threshold value and the amount of communication data in the communication data buffer of said each mobile communication terminal, and, in the notification step, said base station individually notifies the communication mode determined in said step to said each mobile communication terminal by way of an individual data channel between said base station and said each mobile communication terminal.

9. The communication mode controlling method according to Claim 3, characterized in that in the communication mode determination step, when determining that a margin for the amount of interference permitted in the scheduling mode is larger than that in the autonomous mode from load conditions of data communications in the own cell in the scheduling mode, either the base station or the RNC determines the threshold value of the communication data buffer of the mobile communication terminal so that a switching to the autonomous mode within said cell can be suppressed, whereas when determining that the margin for the amount of interference permitted in the scheduling mode is smaller than that in the autonomous mode, either the base station or the RNC determines the threshold value so that the switching to the autonomous mode within said cell can be promoted.

10. The communication mode controlling method according to Claim 3, characterized in that in the communication mode

determination step, either the base station or the RNC determines the threshold value of the communication data buffer of the mobile communication terminal so that said mobile communication terminal switches to the autonomous mode having a communication characteristic of producing a delay time more difficultly than in the scheduling mode according to a delay tolerance for data communications which is set as a QoS parameter.

11. The communication mode controlling method according to Claim 3, characterized in that in the communication mode determination step, either the base station or the RNC determines the threshold value of the communication data buffer of the mobile communication terminal so that said mobile communication terminal switches to a communication mode having a communication characteristic which depends upon a communication service quality of data communications which is set as a QoS parameter.

12. The communication mode controlling method according to Claim 3, characterized in that the mobile communication terminal includes a step of notifying information about the amount of communication data of the communication data buffer to the base station at intervals corresponding to a delay tolerance in the data communications handled thereby in advance of the communication mode determination step.

13. A mobile communication system provided with a mobile communication terminal having a function of switching between an autonomous mode in which the mobile communication terminal autonomously carries out data communications with a base station, and a scheduling mode in which the mobile communication

terminal carries out data communications with said base station at a permitted communication timing, and an RNC for managing communication resources for said base station and said mobile communication terminal, characterized in that said RNC includes a communication resource management unit for setting a range of amounts of permissible interference which can be accepted by said base station when carrying out data communications with said mobile communication terminal, said base station includes a communication management unit for notifying information about a switching between the communication modes in said mobile communication terminal, which is used for controlling an amount of interference in each of said communication modes so that it falls within said range of amounts of permissible interference to said mobile communication terminal, and said mobile communication terminal includes a communication management unit for determining a communication mode which said mobile communication terminal should go into according to said information about a switching between the communication modes.

14. The mobile communication system according to Claim 13, characterized in that the communication management unit and/or communication resource management unit of the base station determines a threshold value for switching between the communication modes, which is associated with an amount of communication data in a communication data buffer which the mobile communication terminal has based on the amount of interference in each of said communication modes in a cell of the base station and/or communication characteristics in each of said communication modes, and also determines a communication mode which should be set to said mobile communication terminal according to a result of a comparison between said threshold value and the amount of communication

data in said communication data buffer, and characterized in that the communication management unit of said mobile communication terminal determines a communication mode which said mobile communication terminal should go into according to information specifying said communication mode which said mobile communication terminal has received, as information about a switching between the communication modes, from the communication management unit of said base station.

15. The mobile communication system according to Claim 13, characterized in that the communication management unit and/or communication resource management unit of the base station determines a threshold value for switching between the communication modes, which is associated with an amount of communication data in a communication data buffer which the mobile communication terminal has based on the amount of interference in each of said communication modes in a cell of the base station and/or communication characteristics in each of said communication modes, and the communication management unit of said mobile communication terminal determines a communication mode which said mobile communication terminal should go into according to a result of a comparison between said threshold value and the amount of communication data in said communication data buffer of said mobile communication terminal, which said mobile communication terminal has received, as information about a switching between the communication modes, from the communication management unit of said base station.

16. The mobile communication system according to Claim 13, characterized in that for the base station, the communication resource management unit determines the range of amounts of

permissible interference in consideration of the amount of interference which is estimated from communication states of other base stations which are managed thereby, as well as conditions of communications between the base station and the mobile communication terminal.

17. An RNC disposed in a mobile communication system provided with a mobile communication terminal having a function of switching between an autonomous mode in which the mobile communication terminal autonomously carries out data communications with a base station, and a scheduling mode in which the mobile communication terminal carries out data communications with said base station at a permitted communication timing, said RNC managing communication resources for said base station and said mobile communication terminal, characterized in that said RNC includes a communication resource management unit for determining a threshold value for switching between said communication modes, which is associated with an amount of communication data in a communication data buffer which said mobile communication terminal has based on an amount of interference in each of said communication modes in a cell of said base station and/or communication characteristics in each of said communication modes.

18. A base station with which a mobile communication terminal can autonomously carry out data communications in an autonomous mode and can carry out data communications in a scheduling mode at a communication timing which is permitted thereby, characterized in that said base station includes a communication resource management unit for determining a threshold value for switching between said communication modes,

which is associated with an amount of communication data in a communication data buffer which said mobile communication terminal has based on an amount of interference in each of said communication modes in a cell of said base station and/or communication characteristics in each of said communication modes, and a communication unit for notifying said threshold value to said mobile communication terminal as information about switching between the communication modes.

19. A base station with which a mobile communication terminal can autonomously carry out data communications in an autonomous mode and can carry out data communications in a scheduling mode at a communication timing which is permitted thereby, characterized in that said base station includes a communication resource management unit for determining a threshold value for switching between said communication modes, which is associated with an amount of communication data in a communication data buffer which said mobile communication terminal has based on an amount of interference in each of said communication modes in a cell of said base station and/or communication characteristics in each of said communication modes, and for determining a communication mode which should be set to said mobile communication terminal according to a result of a comparison between said threshold value and the amount of communication data in said communication data buffer of said mobile communication terminal, and a communication unit for notifying said threshold value to said mobile communication terminal as information about switching between the communication modes.

20. A mobile communication terminal having a function of switching between an autonomous mode in which said mobile

communication terminal autonomously carries out data communications with a base station, and a scheduling mode in which said mobile communication terminal carries out data communications with said base station at a communication timing permitted by said base station, characterized in that said mobile communication terminal includes a communication management unit for determining a communication mode which said mobile communication terminal should go into according to a result of a comparison between a threshold value of an amount of communication data which is notified from said base station using the communication mode controlling method according to Claim 1, and an amount of communication data of a transmission data buffer of said mobile communication terminal.

21. A mobile communication terminal having a function of switching between an autonomous mode in which said mobile communication terminal autonomously carries out data communications with a base station, and a scheduling mode in which said mobile communication terminal carries out data communications with said base station at a communication timing permitted by said base station, characterized in that said mobile communication terminal includes a communication management unit for determining a communication mode notified from said base station using the communication mode controlling method according to Claim 1 as a communication mode which said mobile communication terminal should go into.